AN ANALYSIS OF FACTORS RELATED TO EXPENSE BUDGETING FOR NURSING SERVICES

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AN ANALYSIS OF FACTORS RELATED

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tle of Study: AN ANALYSIS OF FACTORS RELATED TO EXPENSE BUDGETING FOR NURSING SERVICES

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pe and Method of Study: Hospital budgeting has traditionall been based on the statistical variable of patient days. Hillcrest Medical Center uses this variable to project monthly expenditures. Variances of up to 34 percent for the 1972 data used in the study have resulted from using patient days. The purpose of this study was to determine whether a more appropriate variable or combination of vari ables existed for accurately projecting budget expenditure for nursing services. The nursing units selected for stud were a general medical unit with student nurses (2W), a general medical unit with private physicians (4S), the in- tensive coronary care unit (ICCU), and the psychiatric uni (2N). A combination of several techniques was used in the study. Six variables were initially considered: patient days, patient capacity, turnover and the demographic char- acteristics of age, sex and race. Graphical analysis indicated that a better combination of predictor variables possibly could be obtained using multivariate techniques. Both factor analysis and multiple regression analysis were employed to screen the variables and to develop predictor equations. The use of factor analysis developed combina- tions of the independent or predictor variables, called factors, which combine the effects of variables which are highly intercorrelated and at the same time independent of other factors. Regression techniques were then used to obtain prediction equations, using the factors as the inde pendent variables.

dings and Conclusions: The results of this analysis were different for each of the four nursing units. For 2W the three factors required in the prediction equation develope were respectively "patient days-capacity," "age-sex," and "race-turnover"; for 4S the only factor required was "patient days-capacity"; for ICCU the two factors required were "patient days-capacity" and "race"; and for 2N the tw factors required were "turnover-race" and "sex-patient day capacity."

ISER'S APPROVAL Mitchell O. Locks

PREFACE

This study is concerned with the analysis of factors
ecting expense budgeting for nursing services at Hill-
st Medical Center in Tulsa. The primary objectives are
identify those factors or combinations of factors which
best predict expenditures for nursing services and to
velop prediction models. Factor analysis is used as a
st step to develop some insight into the relationships
ng the variables. The statistical technique of regres-
n analysis is then used to incorporate the independent
iables into prediction equations.

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CHAPTER I

INTRODUCTION

The use of budgets in the planning and controlling of rations has long been an established practice by indus- al firms. With the rising costs of today's health care vices, hospitals must be able to provide their patients h continued high standards of medical care at the lowest sible prices. In order to successfully operate a hospital, effective budget is essential. The American Hospital ociation [4], page 1, defines an effective budget as:

> ". . . the systematic presentation of a collection of carefully conceived plans of all the individually supervised activities of the hospital, reduced to numerical terms."

The nature of the services provided by a hospital dic- e budget considerations not generally found in other iness enterprises. The need for an around-the-clock opera- n, standby facilities and above average capacity staffing a few needs that present different problems from regular iness budgeting. Admissions and releases, and thus demand services, are usually determined and controlled by pri- e physicians who are not employees of the hospital.

Also, whereas profit maximization is the primary goal most enterprises, the effectiveness of health care

omes of prime importance in the hospital. Most of the pital employees are concerned primarily with the maximizing health care service. However, within the parameters estab-hed for effective quality care, efficiency in terms of cost t be sought [4], page 2.

The one statistical element most readily available to pitals and the one on which hospital budgeting has tradi-nally been based is patient days. For purposes of budget paration, there is a strong presumption by most hospitals t the type of patients served in the future will be very ilar proportionately to those served in the immediate past. making the budget projection, however, it is necessary to sider many possible variables. Some of these variables are ulation trends, availability of other facilities, medical ff available, probable patient mix, length of stay and any er pertinent external environmental factor that may affect volume or type of services demanded.

Hillcrest Medical Center in Tulsa, like most other hos-als, uses the traditional method of forecasting expenses the coming year on the basis of projected patient days. accuracy of their budget projections, while adequate, has n somewhat less than desired in the past.

Purpose of the Study

This study is concerned with the improvement of the get forecast for expenditures for nursing services at lcrest Medical Center. To clarify the purpose of the

ıdy, two specific objectives have been formulated. These ectives are:

1. To identify whether a variable or combination of variables exist which would enable the accurate projection of budget expenditures for nursing services at Hillcrest Medical Center.
2. To use the identified factors to develop a model or series of models for forecasting budget expenditures.

The means chosen to accomplish these objectives consists a combination of the statistical tools of factor analysis regression analysis.

Scope of the Study

The size of the operation at Hillcrest Medical Center essitates that any study be reduced in scope to a size t is manageable. At the suggestion of Mr. John Cooper, ector of the Hillcrest Computer Center, Nursing Services selected as the area to be studied since this was an a considered most representative of the hospital as a le and also an area very important in hospital budgeting. geting for nursing services is accomplished by ward or g. Therefore, with 25 wings in the hospital, even this ume of data has proven to be unmanageable. Therefore, r nursing units, each representative of a different sit- ion, were selected for a detailed study. In addition to resenting different situations, two of these nursing units e a record of staying reasonably close to their budgeted enses while the other two have wide variances between ir actual and budget expenses.

In planning the operation of a hospital, the administra- is concerned not only with expenses but also with the ume of services that are provided and with the revenues t are generated from these services. The scope of this dy, however, is limited to expense budgeting.

Limitations of the Study

To provide a proper prospective for evaluating the study, limitations should be specified.

First, there is the problem of available statistical in- mation. Demographic characteristics such as patient income ial status, etc. could not be measured from patient data umulated by the hospital. Information concerning the metho payment used by patients was too varied to be effectively sured.

A second limitation is the possible effect of the budget deline on expenditures during the period studied. The sence of budget restrictions, for example, may have caused various nursing units to underexpend during some months led to overexpenditures during other months.

Finally, the inherent limitations of the statistical ls chosen for the analysis must be considered. Factor lysis and multiple regression analysis are the tools uti- ed in this study. The univariate regression analysis cedure performed by the Statistical Analysis System (SAS)] applies the principle of least squares in fitting a ear model to the data. Therefore, the variables chosen

ld have to be linearly related if this were to represent rue optimum. The linear relationship of the data is as- ed to be adequate. The use of factor analysis enables avoidance of the problem of intercorrelation among the ependent variables.

Summary

This chapter presents a brief review of the problem kground. The identification of a variable or combination variables to enable accurate projection of budget expen- ures for nursing services at Hillcrest Medical Center and development of a model or series of models are identified the purposes of the study. Also in the chapter, the scope limitations of the study are stated.

In Chapter II a review is made of some of the pertinent erature in the field. The methodology used in gathering analyzing the data is described in Chapter III. This in- des a brief discussion of the data gathering technique, preliminary analysis of the data and a discussion of the statistical techniques used to analyze the data, factor lysis and regression analysis.

Chapter IV, Analysis of Results, is concerned with the ults obtained from the study. Results of each statistical hnique are discussed.

The final chapter, Chapter V, presents a brief summary some conclusions that can be drawn from the results of study.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to review selected erature and studies pertinent to this study. Specific as that will be covered include: (1) Historical Bud- ing for Hospitals, and (2) Recent Studies Concerning pital Budgeting Factors.

Historical Budgeting for Hospitals

Budget preparation, in hospitals as well as industry, t involve all parts of the organization. Four basic ob- tives of a hospital budget program which incorporate the agement functions of planning, forecasting, and controlling be readily identified. These basic objectives are: To vide a written expression of the policies and plans of the pital reduced to numerical terms; to provide a basis for luating financial performance in accordance with the plans; provide a useful tool for controlling costs; and to create awareness of cost throughout the hospital [4], page 3.

The American Hospital Association [4], page 5, states its budgeting handbook that the prerequisites necessary the establishment of a sound budget system are:

1. A set of well-defined policies and objectives;
2. A sound organizational structure;
3. An accurate accounting system which incorporates responsibility accounting techniques;
4. An accumulation of adequate statistical data, to include a knowledge of trends, economic factors and demographic data;
5. The establishment of a budgetary fiscal period; and
6. A formal reporting program.

McGibony [12], page 298-299, summarizes a number of eral trends that have emerged from an analysis of a num- of hospital-related studies over a period of several rs. One trend has been that hospital operating costs e tended to vary according to the type of control of the pital with private institutions having the highest costs. rage operating costs also generally increase with the e of the institution. One major reason for this trend the increased variety of services offered by the hospi- s of increased size. Hillcrest Medical Center, with the ration of a burn center, psychiatric unit and intensive e units, is affected by these increased operating costs. ther trend shows that the average operating costs of a pital and average patient income will vary with the lo- ion of the hospital. Average patient income has been wn to be highest in proprietary hospitals and average ient income generally increases with the size of a pri- e hospital. In all hospitals, the largest portion of pital income comes from the patients, either directly or

irectly. However, this percentage of patient contribu-
n is greatest in private hospitals where funds in addition
patient income may not be available. Additionally, these
dies have shown that the major portion of all hospital
rating costs can be classified as payroll-related costs
ch generally constitute about two-thirds of the total
pital costs. Costs for nursing services average about
-third of the total hospital operating costs.

Patient days is the one statistical element most readily
ilable and the one that has generally been considered as
viding the most information about the production of ser-
es in the hospital. A patient day is a unit of measure
oting lodging facilities provided and services rendered
one inpatient between a census-taking hour on two succes-
e days [20], pages 95-96. At Hillcrest Medical Center, a
ient day is also counted for any patient who is both ad-
ted and discharged on the same day provided the patient
upied a regular hospital bed and a hospital chart was
ntained for him.

Recent Studies Concerning Hospital Budgeting Factors

Several studies have been conducted recently which
e a direct effect upon this study because they concern
factors upon which hospital budgeting is based.

Since patient days has long been utilized as the pri-
means for projecting volume of service, the first

icle reviewed deals with a method of simply but accu-
ely predicting the number of patient days for a future
geting period. This method, described by Bressanelli
, pages 37-39, is based on the premise that future vol-
s will move in the same direction as past volumes with
atively the same speed. A record of past statistics is
uired. The possibility of making an accurate projection
greater for larger numbers of years of statistics. The
aight-line projecting formula is then used to project
ure volume. The volume can also be projected graphi-
ly. Because this mathematical formula recognizes only
bers and not the conditions generating the numbers, other
tors must be taken into consideration when evaluating the
jected volume. This method of projecting volume of ser-
e is very simple but increasingly sophisticated methods
be developed given the availability of a computer.

Lee and Wallace [11], pages 69-71, hypothesize that
e mix is a more meaningful measure of hospital output
n aggregate patient days. Case mix is defined as the
ws of different types of cases through a hospital. As
art of their study, Lee and Wallace classified admissions
52 Missouri hospitals in 1966 under five different classi-
ation schemes. The classification schemes were:

1. Classification based on duration and extent of disability.
2. Classification based on risk of dying.
3. Classification based on cellular process within the body.
4. Classification consists of 17 groups based on the International Classification of Disease Adapted (ICDA)

5. Classification based on medical specialty (20 groups).

Their findings, using a regression technique, showed
:t the latter three schemes produced better results than
l the use of patient days. Two difficulties associated
:h this approach, however, are that the data on case mix
: not widely available and that there are a very large
ıber of specific cases which must be grouped into a much
.ller number before statistical analysis can be under-
:en.

Blanco, Stahl, and Williams [2], pages 28-32, produced
ther study of some significance which proposed the imple-
tation of a patient evaluation system in order to allow
: hospital to reduce costs and to base patient charges on
:ient needs. The study was designed to evaluate patient
:ds and relate the evaluation to the multiple facets of
sing staffing. The elements of nursing care eventually
:ntified and used in the study were:

1. admit/discharge/transfer
2. vital signs
3. eledrolyte balance/nutrition
4. diagnostic studies
5. hygienic care
6. activities (ambulatory, bed rest, etc.)
7. degree of respirator integrity
8. degree of bowel and bladder integrity
9. drainage tubes
10. dressings/compresses
11. assist physician
12. communication activities (physician's orders, graphic sheets, Kardexes)
13. special needs
14. medications

At the end of the 28-day test period, the study team
w the following conclusions:

1. Most of the activity on a nursing unit is related to patient care and consists of visible, identifiable and measurable tasks.
2. Standard times and minimum skill levels can be established by management.
3. Standard times can be added to determine staffing requirements.
4. Standard times are a function of the physical arrangement of a nursing unit and must be developed for each hospital.
5. A nursing care plan can be developed and used as a work sheet by nursing personnel for each patient.
6. Staffing a unit based on patient needs can reduce costs by assigning appropriate skill levels, rather than by reducing the number of nursing personnel.

The approach used by Myles P. Lash [9], pages 9-10, in eloping an expense budgeting procedure for Annapolis Hos- al in 1970 involved using the technique of regression lysis to project the volume of patient days for all nursing ts. This figure is then related to the production volume imates of each hospital cost center. The hospital depart- ts are categorized into one of three different types of t centers. These cost centers are (1) one where there is irect relationship between the number of patient days and services provided by the department, (2) one where the ationship between the number of patient days and the ser- es provided by the department is direct but the use of ative value scales is necessary (e.g. radiology and labo- ory); and (3) one where there is only an indirect relation- p between patient days and the output of the department. example of the latter would be the housekeeping or ıtenance department. An exponential smoothing equation then used to make monthly projections for each nursing

t. The administrator is then charged with reviewing estimates and assigning the difference between the ression analysis and the total of exponential smoothing imates. This procedure is based entirely on the admini- ator's subjective evaluation of the situation.

Hermiker [6], pages 7-10, uses a study similar to the e mix mentioned earlier to base the measure of hospital put on treatment degrees. Under this concept, each type treatment is related to a common base of 100.00, which re- sents the 24-hour shift of nursing care. The treatment ree concept is a relative unit of measurement designed measure all types of health care services. Since the atment degrees would be industrially engineered standards ed upon the individual hospital's production capacity, ficient accumulation of statistical data and initial kload would be required to implement such a system.

Summary

In this chapter a review of the pertinent literature made. General information concerning budget preparation hospitals as well as specific studies concerning the tors of hospital budgeting are presented and discussed.

Two implications of the literature review can be in- preted as important to this study. The first is the blem of data availability and data collection which arose nearly every discussion of a statistical evaluation of

spital budgeting. These same problems must be taken into nsideration when evaluating the results of the present udy.

Also strongly implied by several of the studies consi-red in the review is the speculation by a number of the searchers that the projection of patient days is insuffi-ent by itself as a forecasting tool for hospital operating sts. This implication provides the launching vehicle for e present study to determine if another factor or combi-tion of factors might be a more appropriate predictive ol.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to describe the pro-
ures and methods of analysis employed in conducting the
earch reported in this study. The chapter is divided
o two major sections. The first section discusses the
earch design and the second section discusses the vari-
methods of analysis used in the study.

The Research Design

The size of the operation at Hillcrest Medical Center
essitates that any study of this nature be reduced in
pe to a size that can be managed. At the suggestion of
John Cooper, Director of the Hillcrest Computer Center,
sing Services was selected as the specific area to be
died. Nursing Services was an area that was considered
be most representative of the hospital as a whole and
o was a very important area in hospital budgeting since
sing services account for nearly one-third of the entire
pital expenditures.

Budgeting for Nursing Services at Hillcrest Medical
ter is accomplished by nursing unit or wing. Therefore,
h 25 such nursing units in the hospital, even this

ume of data proves to be unmanageable for the scope of s study. Therefore, four individual nursing units, each resentative of a different situation, were selected for ailed study. The nursing units were selected specifily because of the type of situation they represented. attempt was made to select a random sample of the twenty- e nursing units. The four nursing units selected are wn in Table I.

TABLE I

NURSING UNITS SELECTED FOR STUDY

Nursing Unit	Type	Rated Capacity
Two West (2W)	General Medical and Teaching	34
Four South (4S)	General Medical (Private Physician)	27
Two North (2N)	Psychiatric	26
ICCU	Intensive Coronary Care	6

In addition to the fact that the four nursing units ected represent a cross-section of the nursing units at lcrest Medical Center, two of the nursing units had a

ord of staying reasonably close to their budgeted enses while the other two had wide variances between ir actual and budgeted expenses. Of the four nursing ts shown in Table I, ICCU and 4S have generally tended remain closer to their budgeted expenses than have the er two nursing units.

It should be pointed out at this time that any con- sions reached about ICCU must be qualified because of carcity of original data. First, the rated capacity of U is only six patients per day. Therefore, a small nge (such as the admission of a very old or very young ient) could have a significant effect on the statistics. ondly, to compound the problem further, the only demo- phic statistics available for ICCU patients are for se patients who die while in the unit. Otherwise, the ients are transferred to other nursing units and the tistics charted there. For these reasons, any extracted tor patterns may not represent true correlations as ac- ately as desired.

Since the calendar year and the budget year coincide Hillcrest Medical Center, the study utilizes data from year 1972. This represents the most recent full year a that was available at the initiation of the study.

The number of patient days budgeted at Hillcrest Medi- Center is based on the prior year's activity, historical nds, a projected growth factor and any additional current formation which is likely to effect the level of demand

hospital services. Examples of such current infor-
ion are increased or decreased capacity in a particular
t, availability of other health services in the area
ved by the hospital, government programs, population
nds in area served and increasing or decreasing instances
certain types of illness.

Methods of Analysis

liminary Data Analysis

A preliminary analysis of the data was made to deter-
e whether the past variances between actual and projected
enditures could be attributed simply to incorrect fore-
ting of patient days rather than to any weakness of
ient days as a forecasting tool. The method selected for
s preliminary analysis was a graphical plotting of the
centage of actual to projected expenditures opposed to
percentage of actual to projected patient days for each
the nursing units. If incorrect forecasting of patient
s were the only reason (or even the main reason) for the
iations in expenditures, then the two graphs should rea-
ably coincide.

evant Variables

The preliminary analysis of available statistical data
lded the following independent or predictor variables on
ch to base the study: patient days, patient capacity

·cent of days under or over 70 percent), turnover and demographic characteristics of age, sex and race.

Patient days was included as a variable since this the current standard and appeared likely to have some ·elation with actual expenditures. The failure to ıtain full capacity operation at all times was also ›thesized as possibly affecting the costs incurred by ;ing units. Statistics for patient days and capacity › obtained from 1972 accounting worksheets.

The demographic characteristics of age, sex and race › included to determine whether patients who were older ınger), of a particular sex or a particular race caused hospital to incur more or less costs for nursing ser- ›s. Additional demographic characteristics such as ›me level, social status and profession could not be ›rmined from the hospital records and thus could not be .uded in the study. The demographic statistics were ob- ıed from the Monthly Patient Listing, CPHA Form 110-71, Hillcrest Medical Center. Calculations were made from ıiled information on each patient taken from the listing.

Patient turnover was included as a variable since the ıor hypothesized that a patient would require the most ›ntion and thus increased costs during the first few days ıis stay and progressively less attention after this ini- . period. Hospital charges, too, seemed to accumulate .dly at the beginning of a hospital stay and to tail off .dly thereafter. Patient turnover, measured as the average

ngth of stay of a patient discharged during a particular nth, was computed from detailed information for each tient on the monthly patient listing.

Although the inclusion of several additional variables uld have been desirable, the availability of statistical formation limited the study to the six variables mentioned ove. Additional variables which would have been desirable clude patient income, patient social status, profession, c. Information was available concerning the method of spital payment for each patient but the large number of pes and combinations of types of payments made the mean-gful inclusion of this variable impossible.

ctor Analysis

Factor analysis is a technique that attempts to account r the correlation pattern in a set of observable indepen-nt variables in terms of a minimum number of unobservable latent random variables called factors [16], page 103. this study factor analysis is used to develop combinations the six independent or predictor variables, called factors ıich combine the effects of variables that are highly inter-›rrelated and at the same time independent of other factors. ı this study, it is an approach used as the first step in a ›quence of investigations aimed at developing some insight ıto the relationship among the independent or predictor vari ›les. A further step in this study will involve the use of ›gression analysis.

There are a number of reasons for using factor analysis. applied to this particular study, the major goals of ing factor analysis are to distinguish the patterns of terrelationship among the six independent variables, to duce the number of variables from six to three for easier ndling, and to transform the data to a form required to et the assumptions of the technique of multiple regression alysis.

Many types of factor analysis exist. The R-Factor ana- sis technique described by Rummel [18], pages 193-202, is ed in this study. This technique consists of factor- alyzing a matrix with the independent variables (columns) ferring to the characteristics of entities and the cases ows) being the entities themselves. A case is a month in is study. There are six independent variables (columns) d twelve cases (one for each month) in the input matrix r each nursing unit included in this study. Thus, the in- t matrix for each nursing unit consists of six columns and elve rows. Each column represents the values of one of e six original independent variables (patient days, patient pacity, turnover, age, sex and race). Each row represents e values of the six variables for a particular month during e year. The independent variable (actual expenditures) es not enter into the factor analysis since only the pat- rns of intercorrelation among the independent variables is sired at this time.

The mathematical computations of the analysis were omplished by computer using the Factor Procedure of the tistical Analysis System [21], pages 201-207. Although tor analysis is mathematically complicated, one of its engths is that it can be effectively employed with only inimum understanding of its mathematical foundations.

The first step of the procedure is the calculation of relation coefficients which reveal the strength of the relation of each variable with all other variables. t, the correlation matrix is reduced to the factor ma- x (matrix of factor loadings). In general interpretation, columns of a factor matrix define the factors and the s define the variables. A factor score (loading) which sures the variables that are involved in a factor pat- n, is produced at each intersection. The factors are n rotated which clusters the variables into independent tors. Orthogonal rotation is used so that all factors this study will be uncorrelated which is desirable since y will provide input into a multiple regression analysis.

The next step in interpreting factor scores or loadings the identification of the main scales which make up each tor. Each variable has a coefficient in every factor ch represents its relative importance to the structure of t factor. A coefficient (factor loading) below 0.50 indi- es that the variable contributed very little to the factor thus may be discounted. Factor loadings (coefficients or

:tor scores) above 0.50 represent the basic structure of
: factor; the higher the absolute value of the loading,
: more important the variable.

Each factor is normally given a short name reflecting
:her a descriptive, casual or symbolic approach to the
ıing [18], pages 287-309. The author chooses to use the
ıbolic approach and will label the factors simply as
:tor 1, Factor 2, and Factor 3, together with a nursing
:t designation, to avoid the possibility of the reader
ıfusing the label and the factor or the possibility of
ınsferring surplus meaning to a factor in the label.
: example, Factor 2W-1 refers to Factor 1 of nursing
it Two West which is composed of the intercorrelated
:iables patient days and patient capacity.

gression Analysis

Having accomplished the initial factor analysis, the
xt step is to perform the statistical technique of multi-
: regression analysis on the transformed data. The
rticular programs involved are the R-Square Procedure and
: Regression Procedure of SAS [21], pages 94-126.

The R-Square Procedure is accomplished first. This
ɔcedure performs regressions of the dependent variable
:tual monthly expenditures) on subsets of a collection of
dependent variables (the factors obtained from the factor
alysis). Since three variables (factors) in each nursing
it have been declared to be independent, the R-Square

›cedure evaluates every possible one-, two-, and three-
:tor model. Three of the models in each nursing unit
're only one independent factor, two have exactly two in-
ıdent factors, and the third contains all three factors.
› R^2 value of each model is calculated and printed. R^2
the square of the multiple correlation coefficient and
ı be expressed as the ratio of the sum of squares attri-
:able to regression to the total sum of the squares [21],
ge 121.

The R^2 statistic is one measure of how well a regression
lel accounts for the observed variation in a set of data.
definition R^2 is the sum of squares due to regression
/ided by the sum of squares about the mean. The statistic
close to unity when the model is a good predictor and
›se to zero when the model is a poor predictor [16], pages
4-196.

The evaluation of the R-Square Procedure then will give
› necessary information concerning best models for use in
› Regression Procedure. The Regression Procedure applies
› principle of least squares in fitting a linear model to
› data. The procedure performed in this study was a uni-
:iate multiple linear regression.

The general linear model developed by regression ana-
sis is of the form:

$$E(y) = A_o + b_1x_1 + b_2x_2 + \ldots + b_nx_n$$

›re y is the dependent variable (actual expense), E(y)

ıs the "expected value of y," A_o is a constant, and the are the independent variables. Of primary interest are regression coefficients b_1, b_2, ... b_n. These are the ghts that must be multiplied by each of the corresponding ependent variables to obtain the optimum prediction for dependent variable. The Regression Procedure of SAS], pages 94-95, estimates these parameters as well as the ıe of A_o.

Detailed calculations required in multiple regression lysis are explained by Overall and Klett [14], pages 420-, in Applied Multivariate Analysis.

Summary

This chapter discusses the methodology used in col-ting and analyzing the data. The relevant factors ained from statistical data at Hillcrest Medical Center identified and discussed. The two statistical techniques d in this study are also briefly discussed. Factor Ana-is is used to identify correlations among the independent iables and to reduce the number of variables. A Multiple ression technique is then used to combine these independent iables into predictive equations for the various nursing ts.

The following chapter discusses the analysis of the ults obtained in this study. The last chapter is then oted to a summary of the study and some significant con-sions which can be drawn from the study.

CHAPTER IV

ANALYSIS OF RESULTS

The statistical and descriptive findings of this study presented and analyzed in this chapter. The data used this study was obtained from detailed accounts of the r nursing units involved at Hillcrest Medical Center in sa, Oklahoma for the calendar year 1972.

Preliminary Analysis and Data Review

The major portion of most hospital expenditures go for ary and wage-related expenses. While this figure usually s from 60-80 percent for the hospital as a whole, a re- w of the data shows that for nursing services at Hillcrest, s figure exceeds the 90 percent level in all four of the sing units under study. Exact figures are shown in Table

As can be seen from the expenditure figures in Appendix A budget variances in expenditures are caused for the most t by variances in the salary and wage-related expenditures. variable or combination of variables which could be used predict salary and wage-related expenditures could very ily be used to predict total expenditures.

Next a graphical technique was used to plot the percen- e of actual to projected expenditures opposed to the

centage of actual to projected patient days for each of four nursing units. Figures 1 through 4 are the graphs ained from this technique. The actual data used to con- uct the graphs are contained in Appendix A and Appendix B. ce the two plottings did not come reasonably close to nciding in any of the graphs, it can be inferred that the iations from budgeted expenditures are due to more than t the inaccurate forecasting of patient days for the geted year.

TABLE II

SALARIES AND WAGES AS PERCENT OF TOTAL EXPENDITURES

Unit	Total Dept. Expense	Salary and Wage Related Expenses	Percent of Total
North	$115,048	$110,234	95.82
West	$168,795	$161,739	95.82
r South	$149,975	$144,231	96.17
J	$119,507	$110,696	92.63

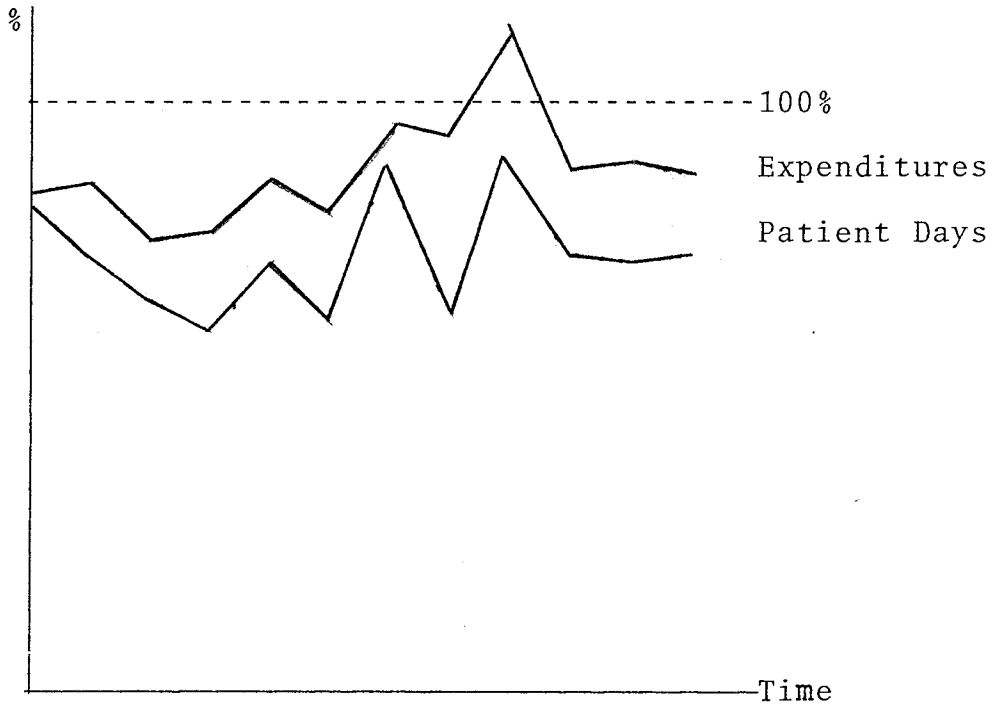

Figure 1. Percentage of Actual to Budgeted-Expenditures vs. Patient Days--Two West

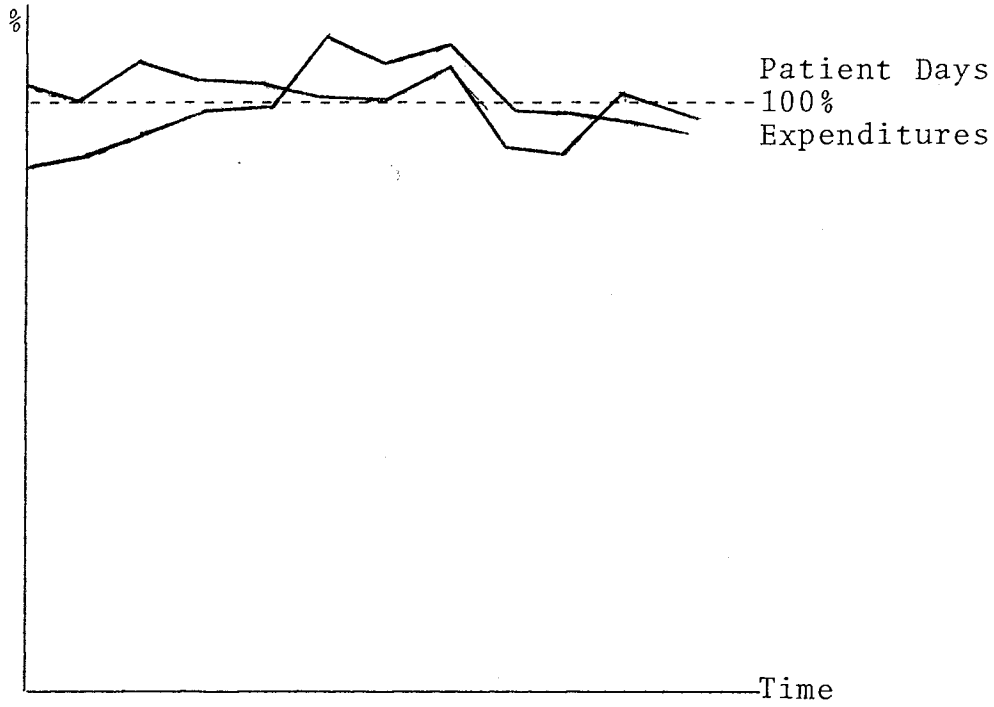

Figure 2. Percentage of Actual to Budgeted-Expenditures vs. Patient Days--Four South

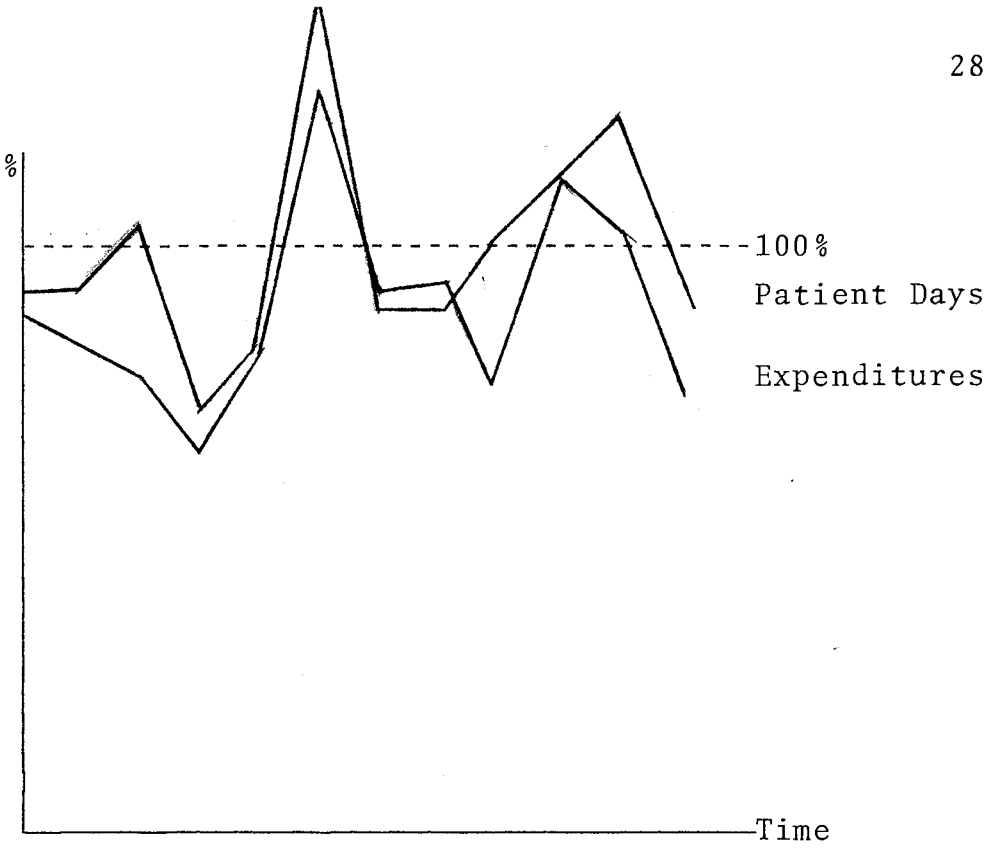

Figure 3. Percentage of Actual to Budgeted-Expenditures vs. Patient Days--ICCU

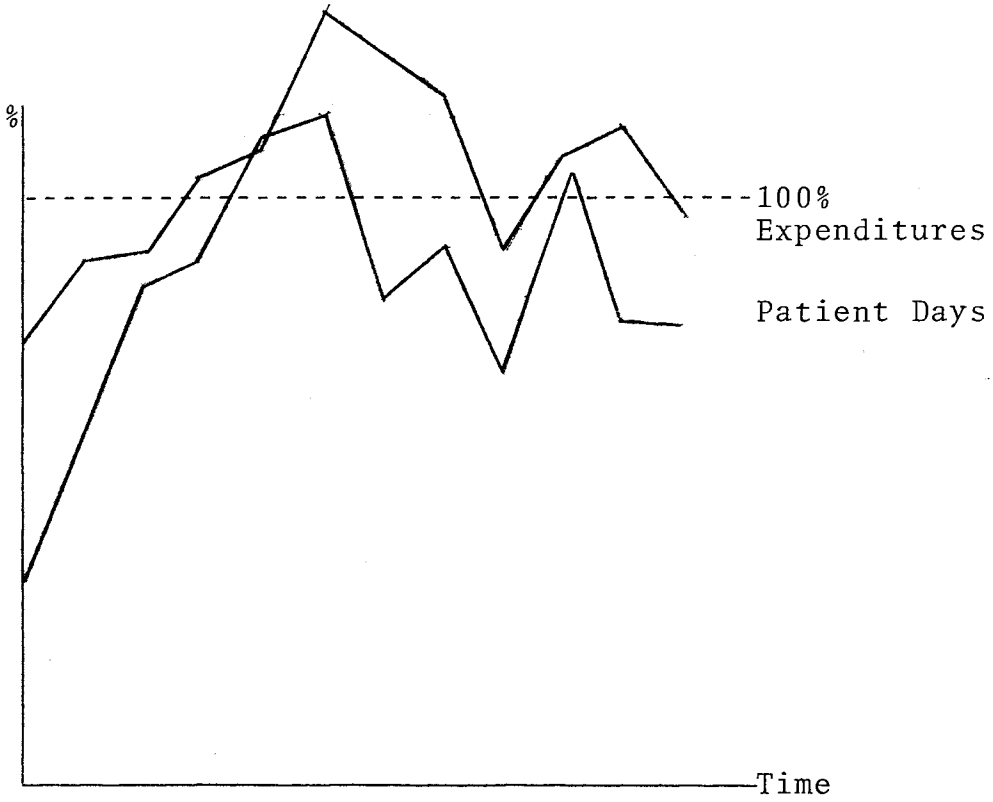

Figure 4. Precentage of Actual to Budgeted-Expenditures vs. Patient Days--Two North

Factor Analysis

An R-Factor analysis was performed using the six inal independent variables which served as character- cs of the 12 cases or months for the 1972 data. Three ors for each nursing unit were extracted as a result are listed in Table III.

TABLE III

FACTORS EXTRACTED FROM FACTOR ANALYSIS INTERPRETATION

sing nit	Factor	Variables Composing Factor	Percent of Variance
Vest	Factor 2W-1	Patient Days, Capacity	40.56
	Factor 2W-2	Race, Turnover	30.04
	Factor 2W-3	Age, Sex	29.40
South	Factor 4S-1	Patient Days, Capacity	44.22
	Factor 4S-2	Age, Turnover	30.49
	Factor 4S-3	Race, Sex	25.29
	Factor IC-1	Sex, Age, Turnover	41.62
	Factor IC-2	Patient Days, Capacity	37.05
	Factor IC-3	Race	21.33
North	Factor 2N-1	Turnover, Age	39.21
	Factor 2N-2	Race	19.81
	Factor 2N-3	Sex, Patient Days, Capacity	40.98

Interpretation is based on the factor loading of a iable being interpreted. The factor loading is the co- icient produced at the intersection of each variable factor and measures the extent to which a particular iable is involved in a factor pattern. Only a loading 0.50 or greater in absolute value is used for the erpretation. The author has labeled the factors to icate the nursing unit to which the factor applies. example, the factors for nursing unit Two West are eled as Factor 2W-1, Factor 2W-2, and Factor 2W-3. No ther attempt is made to attach labels. The factor dings of the variables for each factor are contained Table IV. The rotated factor matrix is used in the erpretation so that each factor will be essentially orrelated.

The two tables can be very easily interpreted. For mple, Factor 2W-1 accounts for 40.56 percent of the al variation in the data for nursing unit Two West and composed of the following two variables:

Patient Days (factor loading of 0.957)
Capacity (factor loading of -0.905)

Factor 2W-2 accounts for 30.04 percent of the total iation in the data for the same nursing unit and is posed of the following variables:

Race (factor loading of 0.853)
Turnover (factor loading of 0.818)

Factor 2W-3 accounts for the remaining 29.40 percent the total variation for that particular nursing unit

TABLE IV

FACTOR LOADINGS

Nursing Unit	Variable	Original Factor Matrix			Rotated Factor Matrix		
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Two West	Patient Days	0.87200	-0.00716	-0.42538	0.95688	-0.06198	0.14806
	Capacity	-0.93317	-0.14043	0.21900	-0.90496	-0.12534	-0.32223
	Age	0.57552	-0.14814	0.64045	0.10669	0.00014	0.86715
	Sex	-0.61123	0.16886	-0.41312	-0.26101	0.06379	-0.70752
	Race	-0.11120	0.81324	0.30423	-0.19291	0.85312	0.03556
	Turnover	0.18306	0.84179	-0.06542	0.25846	0.81797	-0.10256
Four South	Patient Days	0.88375	-0.35599	-0.14228	0.95886	0.04325	-0.08193
	Capacity	0.89346	-0.38247	0.03897	0.96223	0.11123	0.08840
	Age	0.34102	0.61337	0.57282	-0.02307	0.88756	0.17984
	Sex	-0.09781	-0.03187	0.64591	-0.13371	0.23294	0.59635
	Race	-0.06841	-0.59313	0.61920	0.14469	-0.19976	0.82405
	Turnover	0.77350	0.52190	0.00145	0.45616	0.73930	-0.33962
ICCU	Patient Days	-0.50536	0.78425	-0.31586	0.07082	0.98001	0.06903
	Capacity	0.66744	-0.67637	0.17052	0.13597	-0.93691	-0.18908
	Age	0.62987	0.56882	-0.22296	0.85950	0.14706	-0.09817
	Sex	-0.80903	-0.36636	0.16488	-0.88283	0.12445	0.14511
	Race	-0.29897	0.47338	0.78652	-0.03944	0.21612	0.94012
	Turnover	0.66550	0.50280	0.35393	0.79887	-0.14105	0.40358
Two North	Patient Days	0.94607	-0.03706	0.15970	0.55922	-0.07955	0.77645
	Capacity	-0.91338	-0.17636	0.01998	-0.59658	-0.18497	-0.68966
	Age	-0.90321	0.12954	0.17016	-0.77480	0.04291	-0.50928
	Sex	-0.60418	-0.23988	-0.62235	0.06261	0.00051	-0.89776
	Race	0.00763	0.93243	-0.35402	-0.01933	0.99718	0.00808
	Turnover	-0.58094	0.27726	0.60668	-0.88327	0.02196	0.04211

is composed of the following two variables:

Age (factor loading of 0.867)
Sex (factor loading of -0.708)

Very simply then, for nursing unit 2W the independent iables, patient days and capacity, are correlated, the ependent variables, race and turnover, are correlated the two independent variables, age and sex, are corre-ed. Similar interpretations of correlation patterns used in each of the four nursing units. The factors racted for each nursing unit, as can be seen from the le, are composed of different combinations of the vari-es.

Capacity is measured by the percentage of days in ch occupancy failed to reach 70 percent of rated capacity. ient Days is measured by the total number of actual ient days in the nursing unit during the month. For the aining independent variables, age was measured as the rage age per patient day, race was measured as the per-tage of Caucasian patient days to total patient days and was measured as the percentage of male patient days to al patient days. Finally, turnover was measured as the rage length of stay of patients dismissed during a parti-ar month. The number of factors was limited to three ce three or less factors would provide a much more work-e model.

Regression Analysis

Next, a multiple regression analysis was performed using the transformed data from the factor analysis. This was accomplished in essentially three steps, again using a computer and SAS programs.

The first was to use the R-Square procedure to evaluate all possible one-, two-, and three-variable models for each nursing unit. The factors determined from the factor analysis portion of the study were used as the independent variables and the actual expenditures of each nursing unit by month was used as the dependent variable. The models having the highest value of R^2 in each category were then the models for which additional information would be developed.

The Regression Procedure of SAS was then used to apply the principle of least squares to fit the linear models to the data. This procedure estimates the parameters of a model such as:

$$E(y) = A_o + b_1x_1 + b_2x_2 + \ldots + b_nx_n$$

where y is the dependent variable. E(y) represents the expected value of y. In this case, y is the actual monthly expenditure of the particular nursing unit. Each of the x's refers to an independent variable. In this case, the independent variables are the factors obtained from the factor analysis. The parameters are the beta values, known as

·ession coefficients and the value of A_o which is a
·tant and is known as the intercept value [21], pages
)5.

The program gives the value of the intercept and the
·ession statistics for each model. Additionally for
ı one variable model, it prints the observed value of
dependent variable and the predicted value of the
.able according to the model. The differences between
;e two values are referred to as residuals and are also
ıted along with 95 percent confidence intervals. Resi-
.s are defined as $e = y - \hat{y}$ where e is the residual, y
:he actual value of the dependent variable and $\hat{y}$ is the
licted value of the dependent variable. Table V presents
table of residuals.

After analyzing the values of R^2 and the residuals, it
determined that the models could be improved by elimi-
ıng some of the extreme data points. Most of the larger
ıduals could be logically explained. For example, in
;e of the nursing units studied, data point number twelve
resenting December expenditures showed a very large resi-
l. This can be explained by last minute efforts to stay
ıin budget guidelines or to spend excess money that had
ı budgeted. The majority of other data points showing
ge residuals represent the summer months when vacations
various other factors may have entered the picture.
le VI presents the predicted values and residuals after
nination of these extreme data points. A recomputation

TABLE V

TABLE OF RESIDUALS - UNEDITED

sing nit	Observation Number	Observed Value	Predicted Value	Residual
West	1	14321.000	14047.375	273.625
	2	12995.000	13317.820	-322.820
	3	12092.000	12436.895	-344.895
	4	10741.000	12159.187	-1418.187
	5	11978.000	12202.527	-224.527
	6	11167.000	11885.338	-718.338
	7	11717.000	12213.593	-496.593
	8	12997.000	11345.732	1651.268
	9	14688.000	13660.601	1027.399
	10	12511.000	12181.745	329.255
	11	12206.000	12386.365	-180.365
	12	11705.000	11280.821	424.179
South	1	12103.000	12465.602	-362.602
	2	11600.000	12505.742	-905.742
	3	12224.000	12423.284	-199.284
	4	12009.000	12323.190	-314.190
	5	12322.000	12276.081	45.919
	6	12569.000	12540.799	28.201
	7	13699.000	12614.840	1084.160
	8	13725.000	12352.322	1372.678
	9	12540.000	12721.634	-181.634
	10	12835.000	12299.500	535.500
	11	12467.000	12609.598	-142.598
	12	11360.000	12320.409	-960.409
	1	9131.000	8836.273	294.727
	2	8102.000	8603.523	-501.523
	3	8451.000	8924.238	-463.238
	4	8160.000	8532.637	-372.637
	5	8486.000	8218.064	267.936
	6	9977.000	9220.006	756.994
	7	9418.000	9239.922	178.078
	8	9472.000	8583.884	888.116
	9	8080.000	8726.907	-646.907
	10	8579.000	8246.027	332.973
	11	10171.000	9681.884	489.116
	12	7980.000	9203.634	-1223.634

TABLE V (Continued)

Nursing Unit	Observation Number	Observed Value	Predicted Value	Residua
wo North	1	8139.000	8520.001	-381.0(
	2	8849.000	9409.104	-560.1(
	3	9706.000	10698.693	992.6(
	4	9955.000	9983.966	-28.9(
	5	10686.000	11182.764	-496.7(
	6	11735.000	10437.137	1297.8(
	7	10844.000	9433.134	1410.8(
	8	10915.000	9821.429	1093.5(
	9	9837.000	10054.993	-217.9(
	10	11223.000	11282.111	-59.1(
	11	10672.000	9732.499	939.5(
	12	7420.000	9425.169	-2005.1(

TABLE VI

TABLE OF RESIDUALS - EDITED

:sing nit	Observation Number	Observed Value	Predicted Value	Residual
West	1	14321.000	13954.979	336.021
	2	12995.000	13203.805	-208.805
	3	12092.000	12296.774	-204.774
	5	11978.000	12055.461	-77.461
	6	11167.000	11728.873	-561.873
	7	11717.000	12066.855	-349.855
	10	12511.000	12034.064	476.936
	11	12206.000	12244.747	-38.747
	12	11705.000	11106.441	598.559
r South	1	12103.000	12056.718	46.282
	3	12224.000	12233.974	-9.974
	4	12009.000	12337.486	-328.486
	5	12322.000	12196.653	125.347
	6	12569.000	12563.673	5.327
	9	12540.000	12591.045	-51.045
	10	12835.000	12735.780	99.220
	11	12467.000	12353.671	113.329
J	1	9131.000	8956.266	174.734
	2	8102.000	8665.400	-536.400
	3	8461.000	9066.196	-605.196
	4	8160.000	8576.814	-416.814
	5	8486.000	8183.693	302.307
	6	9977.000	9435.816	541.184
	7	9418.000	9460.705	-42.705
	8	9472.000	8640.856	831.144
	9	8080.000	8819.593	-739.593
	10	8579.000	8218.639	360.361
	11	10171.000	10013.022	157.978
North	1	8139.000	8434.641	-295.641
	2	8849.000	9245.763	-396.763
	3	9706.000	10422.245	-716.245
	4	9955.000	9770.205	184.795
	5	10686.000	10863.859	-177.859
	9	9837.000	9835.002	1.998
	10	11223.000	10954.492	268.508
	11	10672.000	9540.794	1131.205

he regression coefficients and R-Square values after ination of some of the most extreme data points showed t improvement in the R-Square values as can be seen in e VII.

TABLE VII

TABLE OF R-SQUARE VALUES

ursing Unit	Number of Factors in Model	R-Square (Unedited)	R-Square (Edited)
Two West	1	0.52377	0.81456
	2	0.55911	0.85324
	3	0.58240	0.88920
Four South	1	0.04139	0.70808
	2	0.04362	0.70936
	3	0.04420	0.70948
ICCU	1	0.32406	0.53595
	2	0.35253	0.57334
	3	0.35707	0.58219
Two North	1	0.37870	0.69838
	2	0.42804	0.75241
	3	0.46088	0.76055

As can be seen from Table VII, the increase in the ıe of R^2 for 2W (0.81456 for 1 factor, 0.85324 for 2 :ors and 0.88920 for all three factors, indicates that inclusion of all three factors in the model would pro- .y be worth any additional effort required. Therefore, three-factor model containing respectively Factor 2W-1, :or 2W-3, and Factor 2W-2 is recommended.

The R^2 value for 4S, however, increases only very ;htly when increasing the model from one factor to two :ors and even less when increasing from two to three :ors. The use of the single factor model (Factor 4S-1))est for this nursing unit.

The R^2 value for ICCU increases from 0.53595 to 0.57334 ı increasing the model from one factor to two factors. increase to three factors, however, only increases the ıe of R^2 to 0.58219. Either a two- or three-factor model ld be appropriate but the two-factor model consisting of :or IC-2 and Factor IC-3 would probably be adequate. ewise, in 2N the large increase in the R^2 value from a -factor to a two-factor model and then only a small in- ıse when going to a three-factor model indicates that the -factor model consisting of Factor 2N-1 and Factor 2N-3 ld be adequate.

Table VIII presents the regression models for each of four nursing units. The best one-, two-, and three- iable models are presented. The intercept value is the ıe of A_o in the regression equation presented earlier.

x's in the equation correspond to the independent varis or factors. The regression coefficients are the betaes which correspond to each particular independentable.

TABLE VIII

REGRESSION MODELS

sing ıit	Variable	Regression Coefficients		
		Three-Factor Model	Two-Factor Model	One-Factor Model
West	Intercept	12209.852	12239.819	12286.071
	Factor 2W-1	832.492	840.816	875.148
	Factor 2W-3	-203.676	-191.112	
	Factor 2W-2	166.418		
South	Intercept	12383.769	12384.416	12384.616
	Factor 4S-1	-211.215	-211.509	-213.409
	Factor 4S-3	9.899	9.127	
	Factor 4S-2	2.853		
	Intercept	8986.640	8975.066	8954.362
	Factor IC-2	578.275	567.666	548.690
	Factor IC-3	173.078	155.927	
	Factor IC-1	76.329		
North	Intercept	9856.720	9804.940	9783.389
	Factor 2N-1	693.527	723.923	728.797
	Factor 2N-3	202.549	192.116	
	Factor 2N-2	-127.426		

CHAPTER V

SUMMARY AND CONCLUSIONS

A Restatement of Purpose and Methodology

The purpose of this study was to determine whether, d on historical data of selected nursing units at Hill- t Medical Center in Tulsa, a more appropriate variable or ination of variables existed for accurately projecting budget expenditures for nursing services than the vari- currently being utilized (patient days).

First, the data was collected and subjected to a prelimi- analysis to determine whether more detailed statistical niques should be applied. The availability of data tly restricted the number of original variables which d have been used in the study.

Next, the independent variables were subjected to a or analysis to reduce the number of variables and to ide an indepth evaluation of the underlying patterns of tionship and strengths of correlation among the variables. factors were rotated orthogonally to cluster the variables independent factors.

Finally, the statistical technique of multiple regression ysis was used to develop a series of prediction models

each nursing unit studied. This data was then edited elete the data points yielding extreme values of the duals. The edited data was then subjected to multiple ession analysis with improved results.

Study Results

The most significant result of this study is that the combination of variables for predicting expenditures nursing services tends to vary from one nursing unit to her nursing unit. Patient days is a very significant able and in three out of four instances it is the most ificant variable. However, other variables were also ificant in accurately projecting the expenditures. Only he psychiatric unit is patient turnover of more signifi- e than any of the other variables.

Statistical regression models have been developed that ld accurately predict the expenditures for the four ing units involved in the study. A three-factor re- sion model has been developed for 2W which has a standard ation of $386.62 and an R^2 value of 0.8892. The standard ation of the one-factor model developed for 4S is $158.73 the R^2 value is 0.7081. Two-factor models have been loped for 2N and ICCU. The standard deviation of the odel is $597.60 and the R^2 value is 0.7524. The standard ation of the ICCU model is $553.60 and the R^2 value is 33. Inadequate data casts suspicion, however, on the

ulness of the models and relationships developed for
, one of the four nursing units included in the study.

Conclusions of the Study

In concluding this study, it is necessary to point
that the results of the study do not lend themselves
he conclusion that the models and relationships de-
ped can be generalized to all of nursing services, to
r hospital departments, or to the hospital as a whole.
nursing unit and each hospital department would re-
e the identification of factors correlated to its
nditures and the development of individual models.
Factor analysis and multiple regression analysis tech-
es can be used effectively to develop a prediction
l for a nursing unit and probably for other hospital
s. Justification for use of the models developed or
development of further models must consider the cost
athering adequate data as well as any changes occuring
he underlying relationships of the variables.

Implications for Future Study

The prediction models developed using factor analysis
multiple regression analysis can be used satisfactorily.
ver, the limited availability of data greatly restricted
possible number of variables which could have been used
he study. The detailed collection of additional data
a period of time would enable the expansion of this

dy. Likewise, additional study could develop prediction els for other nursing units and other departments of the pital such as Pathology or Inhalation Therapy.

Another possible area of study would be the deter- ation of the effect of future policy changes such as federal government's current emphasis on non-hospital e on the models already developed. In short, numerous sibilities exist for future study in this area.

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APPENDIXES

APPENDIX A

EXPENDITURES

BUDGET YEAR 1972

	Total Department							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	16854	14321	2532	84.9	16854	14321	2532	84.9
February	14982	12995	1986	86.7	31836	27317	4518	85.8
March	15734	12092	3641	76.8	47570	39409	8160	82.8
April	13690	10741	2948	78.4	61260	50151	11108	81.8
May	13847	11978	1868	86.5	75107	62130	12976	82.7
June	13680	11167	2512	81.6	88787	73297	15489	82.5
July	12220	11717	502	95.8	101007	85014	15992	84.1
August	13590	12997	592	95.6	114597	98011	16585	85.5
September	13128	14688	1560	111.8	127725	112700	15024	88.2
October	14110	12511	1598	88.6	141835	125211	16623	88.2
November	13655	12206	1448	89.3	155490	137418	18071	88.3
December	13305	11705	1599	87.9	168795	149123	19671	88.3

BUDGET YEAR 1972

	Salaries and Wages							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	15023	12699	2323	84.5	15023	12699	2323	84.5
February	13381	11638	1742	86.9	28404	24337	4066	85.6
March	10053	10761	3291	76.5	42457	35098	7358	82.6
April	12195	9529	2665	78.1	54652	44628	10023	81.6
May	12367	10402	1964	84.1	67019	55031	11987	82.1
June	12195	10286	1908	84.3	79214	65317	13896	82.4
July	10913	10529	383	96.4	90127	75846	14280	84.1
August	12100	11603	496	95.9	102227	87450	14776	85.5
September	11722	12916	1194	110.1	113949	100366	13582	88.0
October	12601	11360	1240	90.1	126550	111727	14822	88.2
November	12195	11123	1071	91.2	138745	122851	15893	88.5
December	11881	11949	68	100.5	150626	134800	15825	89.4

BUDGET YEAR 1972

	Total Department							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	13520	12103	1416	89.5	13520	12103	1416	89.5
February	12645	11600	1044	91.7	26165	23703	2461	90.5
March	12747	12224	522	95.8	38912	35927	2984	92.3
April	12034	12009	24	99.7	50946	47936	3009	94.0
May	12379	12322	56	99.5	63325	60259	3065	95.1
June	11251	12569	1318	111.7	74576	72828	1747	97.6
July	12712	13699	987	107.7	87288	86528	759	99.1
August	12404	13725	1321	110.6	99692	100253	561	100.5
September	12557	12540	16	99.8	112249	112793	544	100.4
October	13013	12835	177	98.6	125262	125629	367	100.2
November	12820	12467	352	97.2	138082	138096	14	100.0
December	11893	11360	532	95.2	149975	149457	517	99.6

BUDGET YEAR 1972

	Salaries and Wages							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	12117	10791	1325	89.0	12117	10791	1325	89.0
February	11334	10427	906	92.0	23451	21219	2231	90.4
March	11395	10850	544	95.2	34846	32069	2776	92.0
April	10786	10756	29	99.7	45632	42825	2806	93.8
May	11093	11080	12	99.8	56725	53906	2818	95.0
June	10083	11470	1387	113.7	66808	65377	1430	97.8
July	11395	12471	1076	109.4	78203	77849	353	99.5
August	11093	12398	1305	111.7	89296	90247	951	101.0
September	11254	11345	91	100.8	100550	101593	1043	101.0
October	11631	11835	204	101.7	112181	113429	1248	101.1
November	11490	11674	184	101.6	123671	125103	1432	101.1
December	10659	11702	1043	109.7	134330	136806	2476	101.8

	Total Department							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	10180	9131	1048	89.7	10180	9131	1048	89.7
February	9527	8102	1424	85.0	19707	17234	2472	87.4
March	10662	8461	2200	79.3	30369	25696	4672	84.6
April	12298	8160	4137	66.3	42667	33856	8810	79.3
May	10138	8486	1651	83.7	52805	42343	10461	80.1
June	7886	9977	2091	126.5	60691	52320	8370	86.2
July	10138	9418	719	92.9	70829	61739	9089	87.1
August	10138	9472	665	93.4	80967	71212	9754	87.9
September	10375	8080	2294	77.8	91342	79292	12049	86.8
October	7670	8579	909	111.8	99012	87872	11139	88.7
November	9858	10171	313	103.1	108870	98043	10826	90.0
December	10637	7980	2656	75.0	119507	106024	13482	88.77

BUDGET YEAR 1972

	Salaries and Wages							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	8919	7761	1157	87.0	8919	7761	1157	87.0
February	8344	7301	1042	87.5	17263	15063	2199	87.2
March	8919	7574	1344	84.9	26182	22637	3544	86.4
April	10790	7409	3380	68.6	36972	30046	6925	81.2
May	8919	7609	1309	85.3	45891	37656	8235	82.0
June	6469	8655	2186	133.7	52360	46311	6048	88.4
July	8919	8289	629	92.9	61279	54600	6678	89.1
August	8919	7658	1260	85.8	70198	62259	7938	88.6
September	8632	7249	1382	83.9	78830	69508	9321	88.1
October	6689	7895	1206	118.0	85519	77404	8114	90.5
November	8632	8218	413	95.2	94151	85623	8527	90.9
December	8919	7687	1231	86.1	103070	93310	9759	90.5

BUDGET YEAR 1972

	Total Department							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	10692	8139	2552	76.1	10692	8139	2552	76.1
February	9730	8849	880	90.0	20422	16989	3432	83.1
March	10395	9706	688	93.3	30817	26696	4121	86.6
April	9508	9955	447	104.7	40325	36651	3673	90.8
May	9819	10686	867	108.8	50144	47337	2806	94.4
June	8947	11735	2788	131.1	59091	59073	17	99.9
July	8637	10844	2207	125.5	67728	69917	2189	103.2
August	9244	10915	1671	118.0	76972	80833	3861	105.0
September	10654	9837	816	92.3	87626	90671	3045	103.4
October	10395	11223	828	107.9	98021	101894	3873	103.9
November	9507	10672	1165	112.2	107528	112567	5039	104.6
December	7520	7420	100	98.6	115048	119987	4939	104.2

	Salaries and Wages							
	Monthly				Year-To-Date			
Month	Budget	Actual	Variance	Percent of Budget	Budget	Actual	Variance	Percent of Budget
January	9546	7350	2195	77.0	9546	7350	2195	77.0
February	8680	7826	853	90.1	18226	15176	3049	83.2
March	9280	8706	573	93.8	27506	23883	3622	86.8
April	8484	9154	673	107.9	35990	33037	2952	91.7
May	8764	9595	831	109.4	44754	42632	2121	95.2
June	7982	10634	2652	133.2	52736	53267	531	101.0
July	7732	9873	2141	127.6	60468	63140	2672	104.4
August	8249	9680	1431	117.3	68717	72820	4103	105.9
September	9480	8896	583	93.8	78197	81717	3520	104.5
October	9280	10399	1119	112.0	87477	92116	4639	105.3
November	8484	9742	1258	114.8	95961	101859	5898	106.1
December	6704	7906	1202	117.9	102665	109766	7101	106.9

APPENDIX B

PATIENT DAYS

PATIENT DAYS
1972
TWO WEST

ɔnth	Patient Days Budgeted	Actual Patient Days	Difference	Percent of Budgeted
ɹary	961	796	-165	82.8
ruary	856	632	-224	73.8
ch	899	600	-299	66.7
il	780	497	-283	63.7
	791	577	-214	72.9
.e	780	491	-289	62.9
.y	698	619	-79	88.7
;ust	774	487	-287	62.9
ɔtember	750	669	-81	89.2
tober	806	580	-226	72.0
vember	780	553	-227	70.9
cember	760	543	-217	71.4
TAL	9635	7044	-2591	73.1

PATIENT DAYS
1972
FOUR SOUTH

Month	Patient Days Budgeted	Actual Patient Days	Difference	Percent o Budgeted
nuary	775	797	+22	102.8
bruary	725	731	+6	100.8
rch	729	781	+52	107.1
ril	690	721	+31	104.5
y	713	742	+29	104.0
ne	645	651	+6	100.9
ly	729	731	+2	100.3
gust	713	762	+49	106.9
ptember	720	672	-48	93.3
tober	744	688	-56	92.5
vember	735	744	+9	101.2
ecember	682	670	-12	98.2
OTAL	8600	8690	+90	101.0

PATIENT DAYS
1972
ICCU

Month	Patient Days Budgeted	Actual Patient Days	Difference	Percent of Budgeted
nuary	124	115	-9	92.7
bruary	116	110	-6	94.8
rch	124	131	+7	105.6
ril	150	112	-38	74.7
y	124	104	-20	83.9
ne	90	132	+42	146.7
ly	124	111	-13	89.5
gust	124	111	-13	89.5
tember	120	121	+1	100.8
tober	93	104	+11	111.8
vember	120	148	+28	123.3
cember	124	114	-10	91.9
TAL	1433	1413	-20	98.6

PATIENT DAYS
1972
TWO NORTH

Month	Patient Days Budgeted	Actual Patient Days	Difference	Percent Budget
January	574	209	-365	36.4
February	522	322	-200	61.7
March	558	481	-77	86.2
April	510	466	-44	91.4
May	527	576	+49	109.3
June	480	548	+68	114.2
July	465	392	-73	84.3
August	496	464	-32	93.5
September	570	412	-158	72.3
October	558	586	+28	105.0
November	510	413	-97	81.0
December	403	329	-74	81.6
TOTAL	6173	5198	-975	84.2

VITA

Jimmy A. Meier

Candidate for the Degree of

Master of Business Administration

;is: AN ANALYSIS OF FACTORS RELATED TO EXPENSE BUDGETING FOR NURSING SERVICES

)r Field: Business Administration

graphical:

Personal Data: Born in El Reno, Oklahoma, August 10, 1944, the son of Mr. and Mrs. Alvin R. Meier.

Education: Graduated from Kingfisher High School, Kingfisher, Oklahoma, in May, 1962; received the Bachelor of Science Degree from Oklahoma State University in May, 1966, with a major in Accounting; completed requirements for the Master of Business Administration Degree in May, 1974.

Professional Experience: Officer in the United States Army, 1966-Present.